RESPONSE TO EUROPEAN PATENT OFFICE ACTION

v. FÜNER EBBINGHAUS FINCK HANO
PATENTANWÄLTE EUROPEAN PATENT, TRADEMARK AND DESIGN ATTORNEYS

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In response to the communication of October 5, 2006.

New claims 1 to 4 are filed, on which the further examination procedure is to be based. The wording of new claim 1 has been amended by introducing features disclosed in the description of the invention (p.6, line 17 to p.7, line 3). Moreover, the wording of claim 1 has been redrafted in connection with the examiner's remarks mentioned in the communication and is presented in two-part form with respect to the general prior art solutions known from US 5 839 246 (D1) or US 4 317 641 (D2). In accordance with the examiner's remarks, the wording of claims 3 and 4 has been amended based on the description (two last lines on p. 8). Former claims 5 to 9 are deleted. Finally, all claims have been provided with reference signs according to Rule 29(7) EPC.

Further, amended description pages 1, 3 to 5, 8 and 10 to 12 are filed, which are to replace original pages 1, 3 to 5, 8 and 10 to 12. These description pages have also been adapted with respect to the examiner's remarks as well as with respect to the documents forming the state of the art of the present invention. The units used in the description have been brought into conformity with the requirements of Rule 35(12) EPC.

The title of the invention is amended as follows: "Locking connector".

Grant of a patent is requested for the amended claims 1 to 4, original description pages 2, 6 to 7 and 9, amended description pages 1, 3 to 5, 8 and 10 to 12 and original figures 1 to 4c.

Auxiliarily, oral proceedings are requested should the Examining division have any hesitations to grant a patent on the basis of the attached claims.

With respect to the patentability of the new claims the following argumentation is to be taken into account.

The object of the present invention is to provide a locking connector that takes much less force and less work to make a connection of a main beam and a pair of opposing cross beams of a suspended ceiling grid. This object is achieved by providing a locking connector in which a locking latch pivots from a base in an arc. The above-mentioned technical result is achieved due to a delay in contact between the side of a slot and a locking latch.

The object of D1 is to provide a suspended ceiling grid wherein reinforced cross members are allowed to expand, without collapsing or buckling, during a fire. This object is achieved by providing clips (locking connectors) at the end of the members, which create barriers that are successfully overcome, in stages, to relieve any excess longitudinal compressive forces. The technical result of D1 is to provide a suspended ceiling grid that keeps rectangular framework enclosures relatively intact during a fire.

The features shifted into the preamble of new claim 1 are known from D1.

However, from D1 it is not known that:

- the locking latch (of the locking connector) pivots from the base in an arc.

The applicant draws the examiner's attention to the fact that according to the specification of D1, assigned to the assignee of the present application, "cut-out 51 permits ear 50 to be bent at a suitable angle" (col.5, lines 14 to 16). The specification does not disclose any further explanation referring to pivoting of the ear 50. However, as can clearly be seen in the drawings (e.g. in Fig. 3, 8, 11 or 14), the ear 50 itself ("locking latch" in the present invention) is straight and,

therefore, does not pivot from the base of the locking connector in an arc. Fig. 8 shows unambiguously that the ear 50 is bent from the base in the form of an acute angle.

Thus, the claimed invention according to new claim 1 is new with respect to D1 according to Article 54 EPC.

Further, the object of D2 is to provide a locking connection for a supporting grid system (e.g. for a suspended ceiling grid) capable of withstanding severe tension loads tending to pull them apart, and to accommodate both horizontal and vertical relative angular movement of the interconnected cross tees without separation under such conditions of loading or under elevated temperature conditions. This object is achieved by providing a suspended ceiling grid including a first support member and a pair of second support members having a resiliently yieldable finger engageable through a slot in a web of the first support member for interlocking the first and second members. This provides a suspended ceiling grid with improved properties with respect to seismic disturbances or elevated temperature conditions caused by fire.

Some of the features placed in the preamble of new claim 1 are known from D2.

However, from D2 it is not known that:

- the locking latch pivots from the base in an arc.

The applicant points out that according to the wording of new claim 1 "when the locking connector is stabbed through the slot in the main beam , the locking latch is forced by a side of the slot to flex toward the base to permit the locking latch to pass through the slot, and when the locking connector has been stabbed through the slot , the locking latch flexes back to its relaxed position wherein it is pivoted away from the base". Based on this wording it can be established that the locking latch of the present invention is to be compared with a "resilient yieldable finger" 21 of D2 fulfilling the same function (s. D2, col.3, lines 7 to 8). However, as in D1 the resilient yieldable finger 21 of D2 is straight and does not pivot from the base in an arc.

The element 26 of D2 designed as a spring retainer is not a locking latch, straight or otherwise, and does not pass through a slot (s. e.g. Fig.4). The function of the element 26 is simply to capture and guide the forward edge of the opposing connector while a connection is made, and to

keep the connectors against one another after the connection is made (s. D2, col.3, lines 39 to 49).

Thus, the invention according to new claim 1 is new with respect D2, too.

Further, neither D1 nor D2 disclose ideas which could be used by a person skilled in the art in order to come to the principles of the present invention. Thus, the invention according to new claim 1 is considered as involving an inventive step according to Art. 56 EPC with respect to D1 and D2.

Hence, the requests made above are well-founded.

D. Finck

Enclosures
- new claims 1 to 4
- amended description pages 1, 3 to 5, 8 and 10 to 12

AN/sk

CLAIMS

1. A locking connector (21, 22) for a suspended ceiling grid comprising a main beam (20) and cross beams (26, 27),
   - wherein the locking connector (21) is designed to be stabbed through a slot (23) in the main beam (20) to lock with an opposing identical locking connector (22) already in the slot (23) and has a cantilevered locking latch (40) being integral with and pivoted from a base (41) in the locking connector (21), and
   - wherein, when the locking connector (21, 22) is stabbed through the slot (23) in the main beam (20), the locking latch (40) is forced by a side of the slot (23) to flex toward the base (41) to permit the locking latch (40) to pass through the slot (23), and when the locking connector (21, 22) has been stabbed through the slot (23), the locking latch (40) flexes back to its relaxed position wherein it is pivoted away from the base (41),

   characterized in that the locking latch (40) pivots from the base (41) in an arc.

2. The locking connector according to claim 1, characterized in that the arc forms a radius of about 0.1 cm (0.04 inches).

3. The locking connector according to claim 1, characterized in that the locking latch (40) has a straight portion (43) which forms an angle of about 42° with the base (41).

4. The locking connector according to claim 1, characterized in that a delay in contact between the side of the slot (23) and the locking latch (40) is provided when the locking connector (21, 22) is stabbed through the slot (23).

Locking connector [~~STAB-IN CONNECTOR~~]

BACKGROUND OF THE INVENTION

[~~Field of the Invention~~]

Suspended ceilings are used extensively in commercial and industrial buildings. In such ceilings, a metal grid framework of interconnected main beams and cross beams is hung from a structural ceiling by wires. The grid supports acoustical panels in rectangular openings formed in the grid.

This invention relates to [~~the~~] Locking connectors used in the grid to join a pair of opposing cross beams and a main beam at grid intersections.

[~~Prior Art~~]

Suspended ceilings having metal beams interconnected into a grid that supports panels are well known (U.S. Patents 5,839,246 ~~and~~ or U.S. 6,178,712, for instance). [~~incorporated herein by reference, show such ceilings~~]

The grid in such ceilings has, at each grid intersection, a pair of opposing cross beams and a main beam that form a connection.

[~~The present invention relates to such a connection~~]

Each cross beam in such a connection has a connector at its end that is thrust, or stabbed-in, from opposing sides of the main beam, through a slot in the main beam. The connectors are all identical.

depressed as it passes into the slot to achieve such horizontal alignment. Hence, the profile of the leading edge of the connector is tapered to guide the connector during its travel through the main beam slot.

of the generic kind in U.S. 5,839,246 or U.S. 4,317,641.

Such connectors are ~~well known in the prior art and are~~ disclosed, for instance, ~~in the above referred to patents.~~ This prior art refers to a locking connector for a suspended ceiling grid as described in the preamble of claim 1.

~~Numerous such connections must be made to create a ceiling grid.~~

SUMMARY OF THE PRESENT INVENTION

The object of the present invention is to provide a locking connector

~~The prior art stab-in connector described above is improved so~~ that ~~it~~ takes much less force, and less work, to make the connection.

There is less work and less force necessary, because, in inserting the second connector into the reduced area of the slot of the main beam, (1) there is a delay in the contact between the locking latch and the side of the slot, so that during the delay, (2) elements in the ensuing connection are positioned while offering the least resistance from frictional forces to such positioning, and (3) when contact between elements does occur, the elements are positioned to offer the least resistance to making a connection.

To achieve the above, the locking latch, which in its unflexed position, must extend laterally far enough out from the base of the connector to prevent withdrawal of the first connector through the slot before the second connector is inserted, is pivoted from the connector base in an arc, rather than in an acute bend as in the prior art.

This, as set forth in (1) above, delays contact between the latch and the side of the slot, when the second connector is inserted into the slot and, as set forth in (2) above, such contact is made further out along the latch from the pivot point, closer to the end of the latch, creating a longer lever arm, so that less force is needed to close the latch.

The outward end of the locking latch in an unflexed position, extends to the same position as the prior art straight latch pivoted at a sharp, acute angle. This position is necessary, so that the connector cannot be withdrawn after the latch passes through the slot.

Also, during the delay in (1) above, the second connector into the slot is being positioned vertically by the taper on the leading end of the connector, which engages either the top or bottom of the slot, to the same horizontal level as the first connector, without frictional resistance created in the connection of the prior art, where the locking latch, virtually immediately, forces the first and second connection laterally together.

By adjusting the second connector into the slot more quickly vertically as it travels through the slot[~~, the second connector, when~~] the locking detents and connector ends[~~engage in there~~] by flexing, are in a position, as set forth in (3) above, to offer the least resistance to[~~flexing~~]

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a right side elevational of a connection of two cross beams through a slot in the main beam, showing the connectors of the invention engaged in a connector-to-connector lock.

Figure 2 is a right side elevational view of the connector of the invention, shown in the connection of Figure 1.

Figure 2a is a top sectional view of the connector of the invention, taken on the line A-A of Figure 2, with an enlarged circled portion showing the latch of the invention.

Figures 3 and 3a are views of a prior art corresponding to the views of Figures 2 and 2a.

Figure 3 is a side elevational view of a prior art connector.

Figure 3a is a top sectional view of a prior art connector taken on the line A-A of Figure 3, with an enlarged circled portion showing a prior art latch.

Figure 4 is a group of graphs, 4a, 4b, and 4c which represent the forces involved in making a connection.

Figure 4a is a graph of the force necessary to overcome resistance in making the connection of the prior art.

Figure 4b is a graph of the force necessary to overcome resistance in making the connection of the invention.

Figure 4c is a graph of the forces represented in 4a and 4b, overlapped.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The Prior Art

U.S. Patent 5,839,246, incorporated ~~herein~~ by reference, is representative of the prior art connection ~~which~~ is improved by this invention. The connection itself, ~~and the~~ method of making such connection, is set forth in detail in the '246 patent.

In the present drawings, a connection of the invention is shown in Figures 1, 1a, and [~~with the improvement of~~] the invention is shown more clearly in Figure 2 and 2a. In the present connection, main beam 20, shown in cross section, extends longitudinally in a ceiling grid. Identical connectors 21 and 22 have been stabbed through a slot 23 in the web 25 of the main beam 20 and interconnect. The connectors 21 and 22 are connected respectively to cross beams 26 and 27 by rivets at 28.

c. The friction between the top or bottom of the second connector 22 and the top or bottom of the slot 23 as the second connector 22 was being positioned vertically within the slot 23.

d. The friction between the detents 31 and 33 and ends 30 and 32 on the first connector 21 into the slot and second connector 22 into the slot 23 as the second connector 22 was being vertically positioned within the slot 23.

In the prior art, in an attempt to reduce the total force and work required, the taper 37 or slope on the leading edge of a prior art connector 15, as seen in Figure 3, was made at a gradual incline, so the frictional forces could be spread throughout the length of the insertion, as the second connector into the slot 23 was being adjusted vertically.

[~~The Present Improvement~~]

The present [~~improvement~~ invention] reduces substantially the force necessary to overcome the resistance from the frictions (a), (b), (c) and (d) above and the forces necessary in (3) above to flex the locking latch 40 of the invention toward a closed position, and in (4) above to flex the detents 31 and 33 and ends 30 and 32 relative to one another to create the connector-to-connector interlock.

As in the prior art, in the present [~~improvement~~ invention] the cantilevered leaf spring latch 40 continues to be formed, as by punching, from the connector base 39, as seen, for instance, in Figures 2 and 2a. The latch of the prior art, designated 10 as seen in Figures 3 and 3a, is in the form of a straight lever 11, pivoted at 12. It forms an acute sharp angle with the base 13 of prior art connector 15.

In the [~~improvement of the~~ present] invention, the latch of the invention 40, as seen in Figures 2 and 2a, herein, is formed from the base 41 with a radius 42, for instance 0,1 cm (0,04 inches), before extending in straight lever fashion. The straight portion 43 of the latch of the invention 40 forms an angle of about 429 with the base 41. Such a curve

Since the force necessary to collapse the latch 10 of the prior art was substantial, and arose near the leading edge of the connector, the taper that guided the connector vertically to its fully seated position so that the connector was in place vertically when fully inserted, was gradual, to limit the added resistance at any one point in the insertion.

Thus, even when the connector-to-connector interlock was being created, wherein the detents were flexing, the connector was still being adjusted vertically, in view of such necessity to make the taper gradual rather than abrupt, thereby creating still more resistance.

In the present invention, the taper 38 at the leading edge of the connector 21, 22 is made relatively abrupt, at a steeper angle, so that a relative immediate adjustment is made vertically to the connector as it is being inserted into the slot 23. Even though a more steep, immediate adjustment would normally require a greater insertion force than that of a gradual insertion, there is less, rather than more force required. This reduction in force is obtained by the delayed contact of the locking latch of the invention 40 with the side of slot 23, since there is virtually no drag or resistance from the locking latch of the invention 40.

There is a further benefit that is achieved by early vertical positioning of the connector within the slot 23 during insertion. As the detents 31 and 33, and the ends 30 and 32 of the first and second connectors of the invention 20 and 21 come into contact, the detents and ends are at a position relative to one another, vertically, where there is least resistance to flexing of these elements laterally into the locking position. Whereas in the prior art, contact was made between detents and ends, and force was exerted between these elements, off-center from their most flexible position, the force required to flex the detents and ends, was again substantial.

Figures 3 and 3a show a prior art connector, while Figures 2 and 2a show a locking connector [~~with the improvement~~] of the present invention.

As seen in Figures 3 and 3a, prior art latch 10 in the form of straight lever 11, is pivoted at an acute angle to base 13 of a prior art connector 15. Dotted line 17

represents, in the enlarged portion, the side of slot 23 as the connector 15 of the prior art is inserted into the slot 23. The prior art connector 15 travels the distance at 16 before it encounters the side of the slot at 19, which is at a distance 18 from the end of the prior art latch 10.

In Figures 2 and 2a, there is shown the connector of the invention 22, which is identical to the connector of the invention 21, with the latch of the invention 40. Again, as in Figure 3a, dotted line 17 in the enlarged portion, represents the side of slot 23 as the connector 22 is inserted into the slot 23. The connector 22 travels the distance 46 before it encounters the side of the slot 23 at 47. This is a distance 48 from the end of the latch of the invention 40.

The benefits of the present [~~improvement~~ invention] over the prior art are shown graphically in Figures 4a, 4b and 4c.

Figure 4, including 4a, 4b, and 4c, shows the resistances encountered in a prior art connection compared to the forces encountered in a connection with the improved connector of the invention.

In the prior art, the line from 80 to 81 represents the resistance encountered during the initial insertion of the second connector into the slot, while the latch 10 is being flexed from its initial contact with the side of the slot 23, until the resistance reaches its highest at about 27 pounds at point 81.

The contact of the straight lever 11 of prior art latch 10 is relatively close to the pivot 12 during this travel. At 81, there is a drop off in resistance during travel to point 82 to about 10 pounds. The straight lever latch 10 of the prior art during this drop off, contacts the side of the slot 23 further out along its straight lever 11, as it travels through the slot 23, so less force is necessary, since the lever arm is longer than at the initial contact.

At 82 there is a rise again in resistance due to the flexing of the detents 31 and 33 and connector ends 30 and 32 while they are forming a connector-to-connector lock. The resistance rises to point 83 at which point the connector-to-connector lock

is completed, and all elements have reflexed to a rest position with no further resistance or movement occurring.

The forces required to overcome the resistance encountered in making a connection with the improvement of the invention is shown graphically in Figure 4a. The same movement of the second connector 22 into the slot 23, having the latch of the invention 40, is shown, as was shown with the prior art connector, in Figure 4a. Initial contact with the side of the slot 23 occurs at 90 and rises to 91 where there is a resistance of about 14 pounds. There is a very slight drop off in resistance as the latch of the invention 40 passes through the slot. The resistance then rises to point 93 at about 16 pounds while the connector-to-connector lock is being formed as the detents 31 and 33 and connector ends 30 and 32 are flexing, after which there is a drop off at point 94, where all resistance ends after the connector-to-connector lock is formed.

The force necessary, and the distance over which the force must be applied, is obviously remarkably less, in making the connection, with [~~the present improvement~~] [~~in~~] the connector locking of the present invention.

Figure 4c overlaps the charts of Figures 4a and 4b with the locked position of the prior art connection, and the connection of the invention as an overlapped common point along the horizontal axis at 96. ΔX in the chart represent the distance of the delay in contact between the prior art latch 15, and the latch of the invention 40, with the side 17 of the slot 23, as the second connector into the slot is being inserted. Again, Figure 4c, in chart form, represents the substantial reduction in force, and work necessary to make the present connection, over that to make the prior art connection.